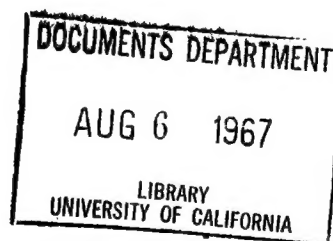


**PRELIMINARY STUDY OF  
FEASIBILITY OF DOUBLE DECKING  
ROUTE 101  
FROM SAN FRANCISCO TO SAN JOSE,**

**REQUESTED BY  
HOUSE RESOLUTION NO. 131  
1966 FIRST EXTRAORDINARY SESSION**



**STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS**

**DECEMBER 1966**

DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS  
1429, SACRAMENTO



December 23, 1966

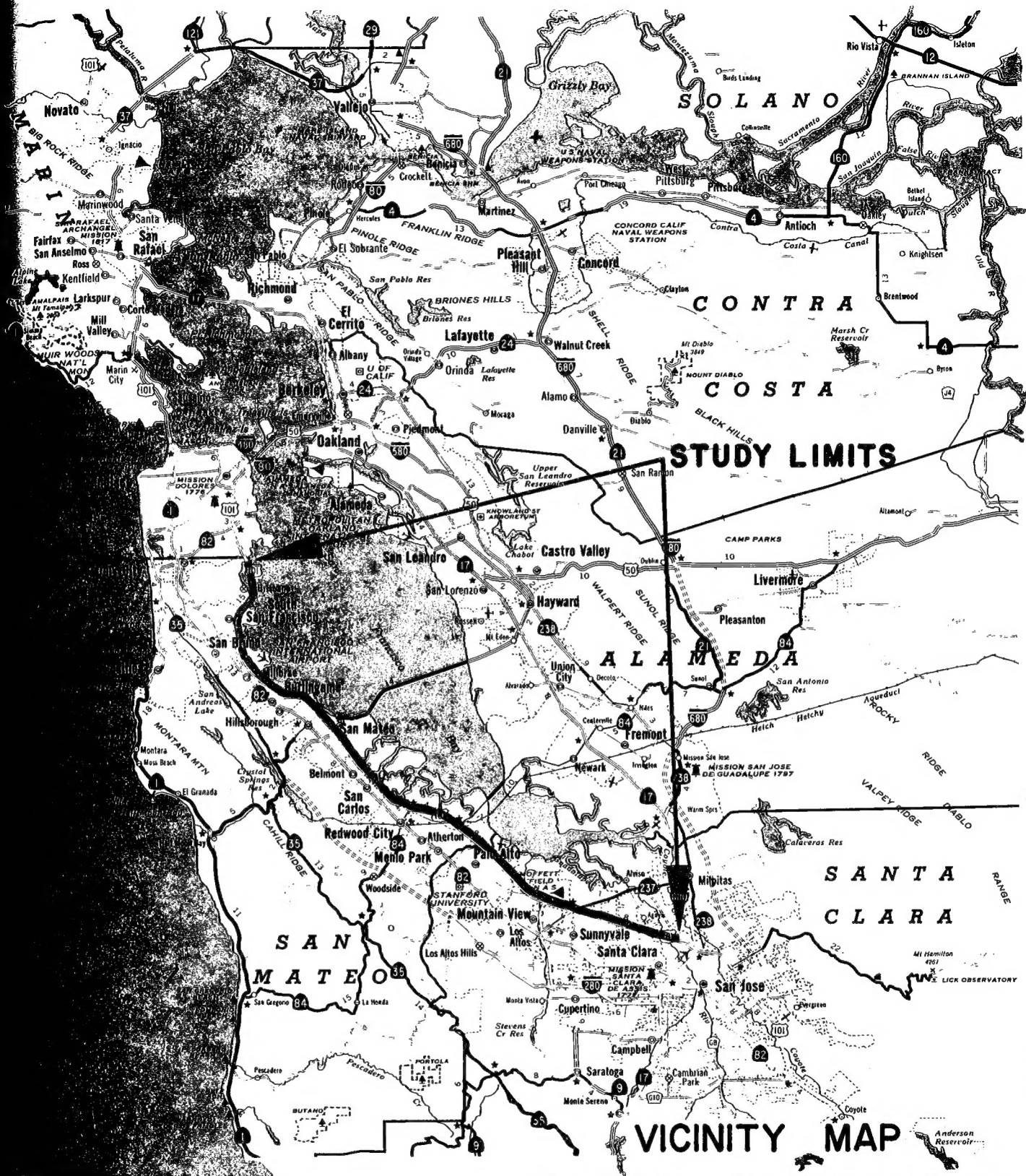
Mr. John Erreca  
Director of Public Works

Transmitted herewith is a preliminary study of the feasibility of double decking Route 101 from San Francisco to San Jose, as requested by House Resolution No. 131, 1966 First Extraordinary Session.

J. C. WOMACK  
State Highway Engineer

Attachment

By   
Deputy State Highway Engineer



SCALE IN MILES  
0 2 4 6 8 10

## FEASIBILITY OF DOUBLE DECKING ROUTE 101

FROM SAN FRANCISCO TO SAN JOSE

HOUSE RESOLUTION NO. 131  
1966 FIRST EXTRAORDINARY SESSION

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS

## CONTENTS

	<u>Page</u>
I. HOUSE RESOLUTION NO. 131 . . . . .	1
II. INTRODUCTION . . . . .	2
III. GENERAL . . . . .	2
IV. PRESENT ROAD . . . . .	3
V. ROUTE PLANNING, RELATED PROJECTS AND LOCAL PLANNING . . . . .	4
1. Route Planning . . . . .	4
2. Related Project - San Francisco International Airport Expansion . . . . .	5
3. Local Planning . . . . .	6
VI. TRAFFIC . . . . .	6
VII. SCOPE OF STUDY . . . . .	7
1. Cost . . . . .	8
2. Visual Appearance . . . . .	8
3. Construction . . . . .	8
VIII. DISCUSSION . . . . .	9
1. Traffic Service . . . . .	9
2. Cost . . . . .	10
3. Impact to Community . . . . .	11
4. Construction . . . . .	12
(a) Foundation . . . . .	12
(b) Utilities . . . . .	12
(c) Traffic Handling . . . . .	13
IX. SUMMARY AND RECOMMENDATIONS . . . . .	13

### Attachments:

Vicinity Map (preceding page)  
Route Study Map (Exhibit A)  
Average Daily Traffic (Exhibit B)  
Typical Sections (Exhibit C)

In Cooperation with  
U.S. DEPARTMENT OF COMMERCE  
BUREAU OF PUBLIC ROADS

I -

HOUSE RESOLUTION NO. 131

Relative to a preliminary study of  
double decking Route 101 from  
San Francisco to San Jose.

RESOLVED BY THE ASSEMBLY OF THE STATE OF CALIFORNIA, That  
the Department of Public Works is hereby requested to  
conduct a preliminary study of the feasibility of double  
deck construction for the portion of Route 101 from  
San Francisco to San Jose and to report to the Assembly  
its findings on or before the fifth legislative day of  
the 1967 Regular Session of the Legislature.

## II - INTRODUCTION

The 1966 First Extraordinary Session of the Assembly adopted House Resolution No. 131, requesting that the Department of Public Works undertake a preliminary study of double decking Route 101 from San Jose to San Francisco and to report its findings to the Assembly on or before the fifth legislative day of the 1967 Regular Session.

Because the Resolution emphasized that the study was to be preliminary in nature, the findings which follow should be considered as a generalized feasibility study not involving a detailed analysis of traffic and design nor alternate solutions.

## III - GENERAL

Route 101 is in the Federal-aid Primary System extending from Los Angeles to the Oregon State line via Crescent City. The portion of Route 101 included in this study is from Route 87 in San Jose to the San Francisco County line -- a length of about 39 miles.

Locally, Route 101 is known as the Bayshore Freeway. It traverses a corridor devoted to land uses described as open space, agricultural, residential, and industrial on the bay or east side and generally residential and industrial on the west side.

Although other routes have been authorized by the Legislature which are in various stages of development, Route 101 is the only major north-south freeway in this corridor presently in operation.

The advantage of good access has attracted development of large traffic generators on both sides of the Route 101 freeway. This trend is anticipated to continue and is in accordance with local planning. The recent real estate market is very active in connection with planned communities which are currently under construction or are planned on the bay side. Such developments include Foster City, Mariner Island, and the proposed Redwood Shores. These communities have anticipated populations of 35,000, 7,000 and 60,000 people, respectively.

Further, it is anticipated that by 1990, 25 million passengers a year will pass through the expanded San Francisco International Airport. Included in the expansion plans is a cargo terminal area of approximately 200 acres south of the present airport. A proposed Marine World exhibition near Redwood Shores is planned to be larger than Marineland near Los Angeles. Another industrial and commercial park development of 165 acres (Anza-Pacific Corporation) is proposed south of the San Francisco International Airport on the east side of Route 101.

#### IV - PRESENT ROAD

Route 101 within the study limits is a six-lane freeway except for an eight and one-half mile eight-lane section from 19th Avenue in San Mateo north to San Bruno Avenue. Grades are flat, and geometric standards provide speeds of at least 60 mph.

There are 34 interchanges constructed and four others planned in the 39 miles studied. The average spacing is one mile, which is the minimum for smooth traffic flow operation. In the Mountain View-Sunnyvale area, there are ten interchanges within approximately six miles.

Existing right of way width is sufficient for widening to eight lanes. Plans to widen to eight lanes, with some sections of ten lanes where required between interchanges, are currently underway.

#### V - ROUTE PLANNING, RELATED PROJECTS AND LOCAL PLANNING

1. Route Planning - Route 101 is one of four north-south routes authorized by the Legislature in the California Freeway and Expressway System along the peninsula in San Mateo and Santa Clara Counties. The others are Routes 1 (Cabrillo Highway), 280 (Junipero Serra Freeway), and 87 (Bayfront Freeway). A portion of Route 35 (Skyline), is also in the Freeway and Expressway System. In addition, there is one other north-south State Highway in the study corridor -- Route 82, El Camino Real, a six- and four-lane street. Traffic characteristics on Route 82 are predominantly local, as this highway is through strip commercial development. It also functions somewhat as an arterial connecting several cities along the peninsula.

Route 280 generally parallels Bayshore Freeway from two to four miles to the west and is in the Interstate System. Portions are completed, portions are under construction, and the remainder of the route from San Jose to San Francisco is



scheduled for completion as a six- and eight-lane freeway by 1971. It is anticipated that Route 280 will greatly relieve congestion on the Bayshore Freeway for some time.

Route location studies for Route 87 have not been initiated with the exception of a very short portion through Foster City in San Mateo where route adoption and freeway agreement were executed on December 14, 1960 and December 6, 1962, respectively. The early action on this portion of Route 87 was undertaken to coordinate the planning of Routes 87 and 92 with the development of Foster City.

Routes 1 and 35 are located so far to the west of Bayshore Freeway that their improvement will not appreciably affect traffic patterns in the Route 101 corridor.

2. Related Project - San Francisco International Airport Expansion - In March 1966, consultants for the San Francisco International Airport requested that the Division of Highways study the feasibility of relocating Bayshore Freeway to the west between the San Francisco International Airport Interchange and the San Bruno Avenue Interchange. The purpose of the westerly shift would be to utilize additional land owned by San Francisco for airport use in connection with their preparation of a new airport master plan.

The study disclosed that the relocation of Bayshore Freeway, including the redesign of the San Francisco International Airport Interchange, could be made at an estimated cost of \$6,800,000. The consultants concluded that the benefits to the airport would not justify such an expenditure.

3. Local Planning - A review of local planning for the various municipalities contiguous to Bayshore Freeway indicates that only the 1965 General Plan of the City of Mountain View contained proposals for a dual freeway adjacent to existing Route 101. The General Plans for San Mateo and Santa Clara Counties, and most affected cities within these counties, showed a future Bayfront Freeway generally in the tidelands. Palo Alto is officially opposed to the Bayfront Freeway through resolutions by the City Council.

The San Mateo County Regional Planning Committee (an advisory committee) opposes a Bayfront Freeway. The San Mateo County Planning Commission has endorsed a Bayfront Freeway.

The Bay Conservation and Development Commission is now working on an overall plan for the Bay Area.

#### VI - TRAFFIC

Exhibit B depicts 1965 (present) and 1990 (future) traffic on Route 101 between Route 87 in San Jose and Route 230 near San Francisco. Future traffic projections are based on the assumption that all freeways in the corridor have been constructed and are in operation except Route 87.

In determining the future volumes, intercounty and intracounty trip desires were analyzed and projected for the San Francisco-San Jose corridor. The resulting projected volumes for 1990 were obtained from preliminary traffic studies of the San Francisco Bay Area, based on land use planning developed by the city and county authorities.

## VII - SCOPE OF STUDY

The study undertaken by H.R. 131 generally investigated the possibilities of double decking the Bayshore Freeway wherever feasible, taking into consideration disruption to existing property, total traffic service, local access problems, functioning of freeway-to-freeway interchanges, construction cost, and visual appearance.

The study indicates that there are sections where double decking merits future consideration. It also discloses that there are three sections where double decking would not be feasible (see Exhibit A). A parallel or side-by-side freeway would probably be preferable to double decking from Sierra Point north to the north project limits because of foundation problems and cost. Because of glide path restrictions, double decking would not be feasible adjacent to Moffett Field Naval Air Station and the San Francisco International Airport.

In considering a double deck facility, it was assumed that the upper deck would primarily serve the longer vehicular trips with direct connections to cross freeways. Access to the existing local service interchanges from the upper deck might be by means of slip ramps spaced four to five miles apart near intersecting east-west freeways, thus reducing the number of major revisions to the existing interchanges. However, some revision of the existing interchanges would be required, as well as adding some local service interchanges with the upper deck.

Several typical sections of the double deck were investigated. One section is a four-lane elevated "T" structure

on each side of the existing freeway, while the alternate scheme is a typical eight-lane elevated viaduct above the existing freeway roadbed (see Exhibit C).

A very preliminary review of the two typical sections indicates that the "T" structure is more desirable for the following reasons:

1. Cost - Cost estimates are about \$10 million per mile for the "T" structure and \$12 million per mile for the overhead eight-lane viaduct.

2. Visual Appearance - Aesthetically, the dual four-lane roadway on "T" structures is the more desirable of the two studied. The "T" structure would not appear as massive and the motorist on the existing freeway would not feel as confined as in the overhead viaduct because of the open space over the inner lanes.

3. Construction - Construction of either of the double deck alternates would be extremely disruptive to the flow of traffic for an extended period of time. However, the "T" structure on each side of the freeway could be constructed with less disruption than the eight-lane overhead viaduct. This is because with the viaduct, it would be necessary to close all lanes of travel during the placing of beams spanning the entire width of the roadway.

Subsequent discussion on double decking will therefore be based on the "T" structure section. It is likely that combinations of these sections might be utilized in a final design.

## VIII - DISCUSSION

As shown on Exhibit B, estimated future traffic indicates a traffic demand in excess of 220,000 cars per day on Bayshore Freeway assuming all freeways presently conceived in the Freeway and Expressway System in operation except Route 87 (Bayfront Freeway). Projected peak hour generation of over 13,000 cars in the direction of heavier travel is greatly in excess of the existing eight-lane capacity of Bayshore Freeway.

This study to double deck Bayshore Freeway reveals the following areas of consideration:

1. Traffic Service - A dual freeway facility without direct interchange connections to the upper level would result in high concentrations of traffic at local interchanges and also on the local streets leading to the interchanges. Costly improvement and widening of existing streets would be necessary. If major modification of existing interchanges and streets are not undertaken, congestion would likely result on many of the local streets and on the freeway, particularly at locations of high traffic generation such as the San Francisco International Airport. Any modification of existing access will be extremely costly in this highly developed area. The addition of more connections to the existing freeway is difficult as present interchange spacings are minimal, averaging only one mile apart.

One of the benefits of double decking the Bayshore Freeway would be that traffic operation for the freeway-to-freeway connections in the San Jose and Mountain View areas

at Routes 87 and 85 would be improved. The linking of these freeways to the upper deck could alleviate the present operational problems caused by connecting six-lane freeways to an already congested eight-lane freeway. Additional local road connections, as mentioned above, could also be made to the upper deck if needed.

2. Cost - The estimated cost for the entire 39-mile project, including side-by-side and double deck sections, is \$450 million for construction and \$25 million for right of way. The cost for construction (exclusive of right of way) of 32 miles of the double deck portion is \$442 million or approximately \$14 million per mile. The three parallel or side-by-side portions cost \$8 million or about \$1.1 million per mile for construction (excluding right of way) for seven miles. The above costs include a lump sum (\$55 million) for revision to existing interchanges and new interchanges to accommodate traffic. No attempt has been made at this time to determine the cost of an alternate eight-lane facility on new alignment or combinations of double decking and new locations. Route 87 studies, when undertaken, should explore such possibilities.

For purposes of comparison, the estimated cost (construction and right of way) for Route 280 (Junipero Serra Freeway) from the San Francisco-San Mateo County line to the Junction of Route 101 in San Jose, a length of 59 miles, is \$288 million or \$4.9 million per mile. This cost is typical of conventional freeways in urban and suburban areas.

From these comparisons it can be seen that the cost of double decking Bayshore Freeway would appear to be much higher than the cost of constructing a typical freeway on new alignment. The savings in right of way costs generally do not offset the increased construction costs of viaduct structure except in special instances where unusually expensive right of way development exists.

3. Impact to Community - Bayshore Freeway traverses a predominantly industrial-residential corridor. The visual or aesthetic impression of the present ground level facility is compatible with present land use development. With double decking, the profile grade of the upper deck would be at least 28 feet above the existing freeway. In some cases, this elevation would have to be increased to 46 feet or more to clear existing interchange structures. The rise and fall in the double deck profile at each interchange could present difficult architectural problems, and would be the most predominant feature of the landscape at the present time.

The use of slip ramps to the freeway and between the upper and lower levels of the freeway would minimize modification of existing interchanges and right of way requirements. It does not completely obviate the need for additional right of way since some would be required to provide auxiliary lanes to handle the weaving conflicts between the vehicles from the upper deck and the existing traffic on the lower deck. It is believed that concentrations of traffic wherever slip ramps and auxiliary lanes would be needed would cause considerable

disruption in the contiguous areas which are extensively built up.

Additional right of way would be required in some sections where the clearance between the frontage road and freeway edge of pavement is inadequate. Examples of such areas are the south (or westerly) side of Bayshore Freeway from Peninsular Avenue in San Mateo to Broadway in Burlingame and near Third Avenue on both sides of the freeway in San Mateo. In Santa Clara County there are areas where additional right of way would be needed because of the overhang of the "T" structure. Estimated costs reflect these right of way requirements.

#### 4. Construction

(a) Foundation - It is not believed that any major construction difficulties relating to foundation conditions for double decking portions of the project would be encountered southerly of Sierra Point. The so-called "open water fill" portion north of Sierra Point appears more suited to side-by-side ground level construction because of foundation conditions.

(b) Utilities - There are the Pacific Gas & Electric Company high power transmission line, a 20-inch gas line and the drainage creek located on the west side of the existing freeway from Millbrae Avenue to San Bruno Avenue. A parallel freeway would require relocation of these utilities and channel at an estimated cost of \$500,000 and \$100,000, respectively.

Generally, no other major problems regarding soil conditions, drainage and utility relocations throughout the study limits are known.



(c) Traffic Handling - Disruption to existing traffic during construction would be a major area for consideration. Major disruption to the smooth flow of traffic would be unavoidable during the placing of the precast members and during the placing of concrete for the roadway deck. The "T" section alternate would require detour lanes within the median; however, it could probably be constructed one direction at a time with lane closures only.

The delay caused by the closing of lanes and the natural tendency of traffic to slow down because of the curiosity of the drivers could result in an increase in users' costs. Also, consideration should be given to the problem of potential accidents which would be likely to occur during construction on this high speed, high traffic volume freeway.

#### IX - SUMMARY AND RECOMMENDATIONS

The chief advantage in a double decking scheme for expanding the Bayshore Freeway Route 101 is that it would require the minimum amount of additional right of way in this highly developed urban and industrial corridor from north of San Jose to the San Francisco County line. Another advantage is that this facility would be more centrally located in relation to the area of greatest future traffic generation than a new route in a new location. Double deck construction of the present route might also avoid any possible conflict with the

plans or policies of the Bay Conservation and Development Commission, since it would minimize encroachment onto the Bay Tidelands. Assuming that this second deck were to be designed to serve the longer vehicular trips, the user would receive considerable benefit from the savings in time, wear and tear on the vehicle, and added comfort. This separation of traffic -- the local user separated from the long distance user -- would be likely to result in smoother overall operation of the freeway (and a subsequent reduction in the number of accidents) than more conventional freeway designs.

The important disadvantage to double decking or to constructing a parallel facility adjacent to Route 101 is the resulting high concentration of traffic into this narrow corridor which would bring about further congestion on already crowded feeder distributor roads and arterials. In order to handle the anticipated traffic, major construction improvements would be needed on these local facilities. Also, some of the interchanges would require major modification.

Although it would be possible to construct a double deck facility along Route 101, the disruption and inconvenience it would cause to the users and communities during construction are major items to be considered.

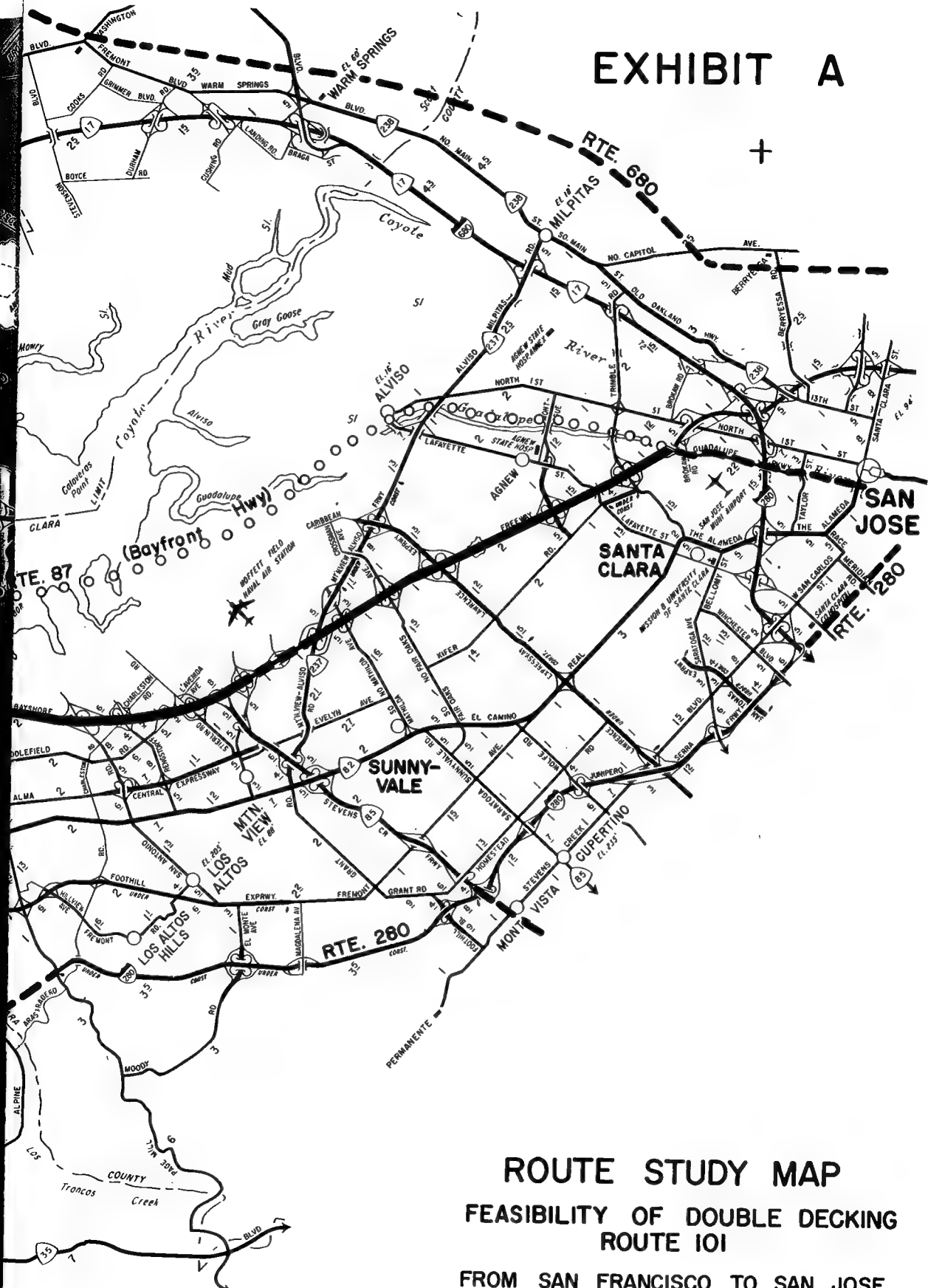
Aesthetically, a double deck freeway throughout most of the length of the west shore of San Francisco Bay is questionable. The physical separation which now exists to some degree would be accentuated by the visual impact of a two-level freeway in an area of predominantly single story development.

The cost of double decking is estimated to be \$475 million, including \$25 million for right of way, which is higher than the average cost of constructing conventional urban and suburban freeways in new locations.

There is indicated merit to the consideration of a dual-at-grade facility on portions of Bayshore Freeway, for example, that section from south of San Francisco International Airport to the San Francisco County line, as an alternate Route 87 alignment.

More detailed study should be made at the above and other locations of the possibility of double decking Bayshore Freeway or constructing side-by-side locations as an alternate alignment for Route 87. All of these possibilities should be studied in detail and feasible alternates presented during future Route 87 location studies.

It is therefore recommended that no conclusion be reached as to the economic justification of double decking Route 101 until route location studies for Route 87 have been completed.



# EXHIBIT A

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## ROUTE STUDY MAP

### FEASIBILITY OF DOUBLE DECKING ROUTE 101

FROM SAN FRANCISCO TO SAN JOSE

HOUSE RESOLUTION NO. 131  
1966 FIRST EXTRAORDINARY SESSION

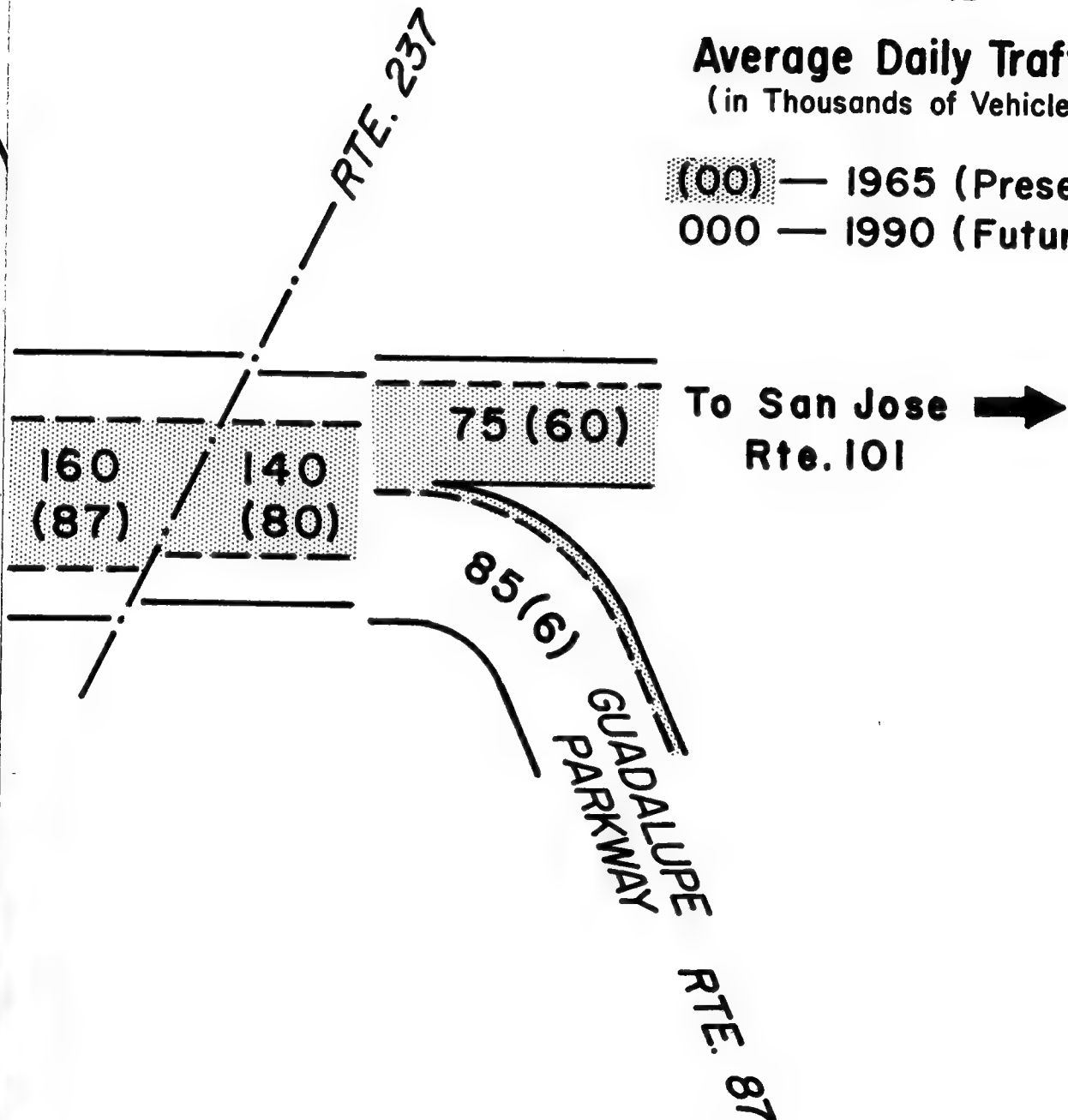
STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS

# EXHIBIT B

- LEGEND -

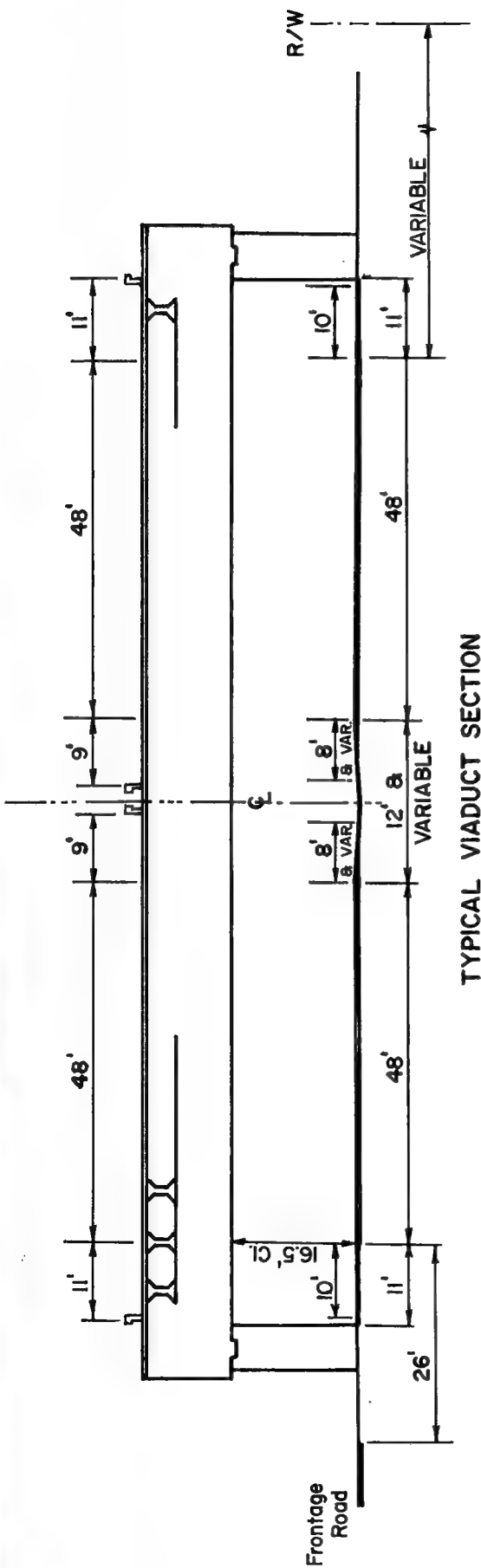
**Average Daily Traffic**  
(in Thousands of Vehicles)

(00) — 1965 (Present)  
000 — 1990 (Future)

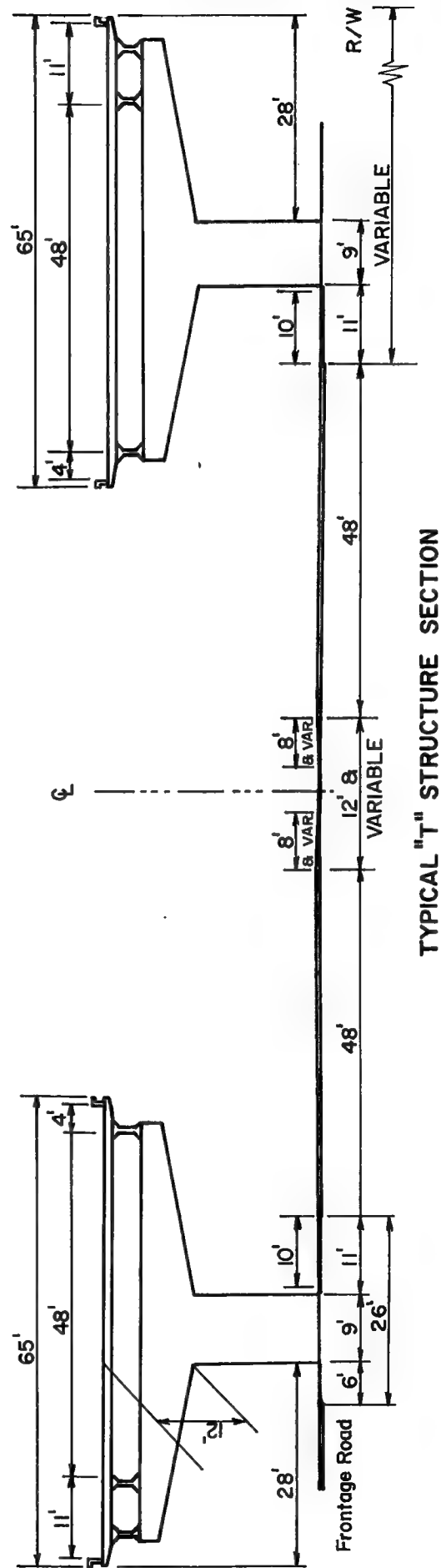


# EXHIBIT C

## TYPICAL SECTIONS

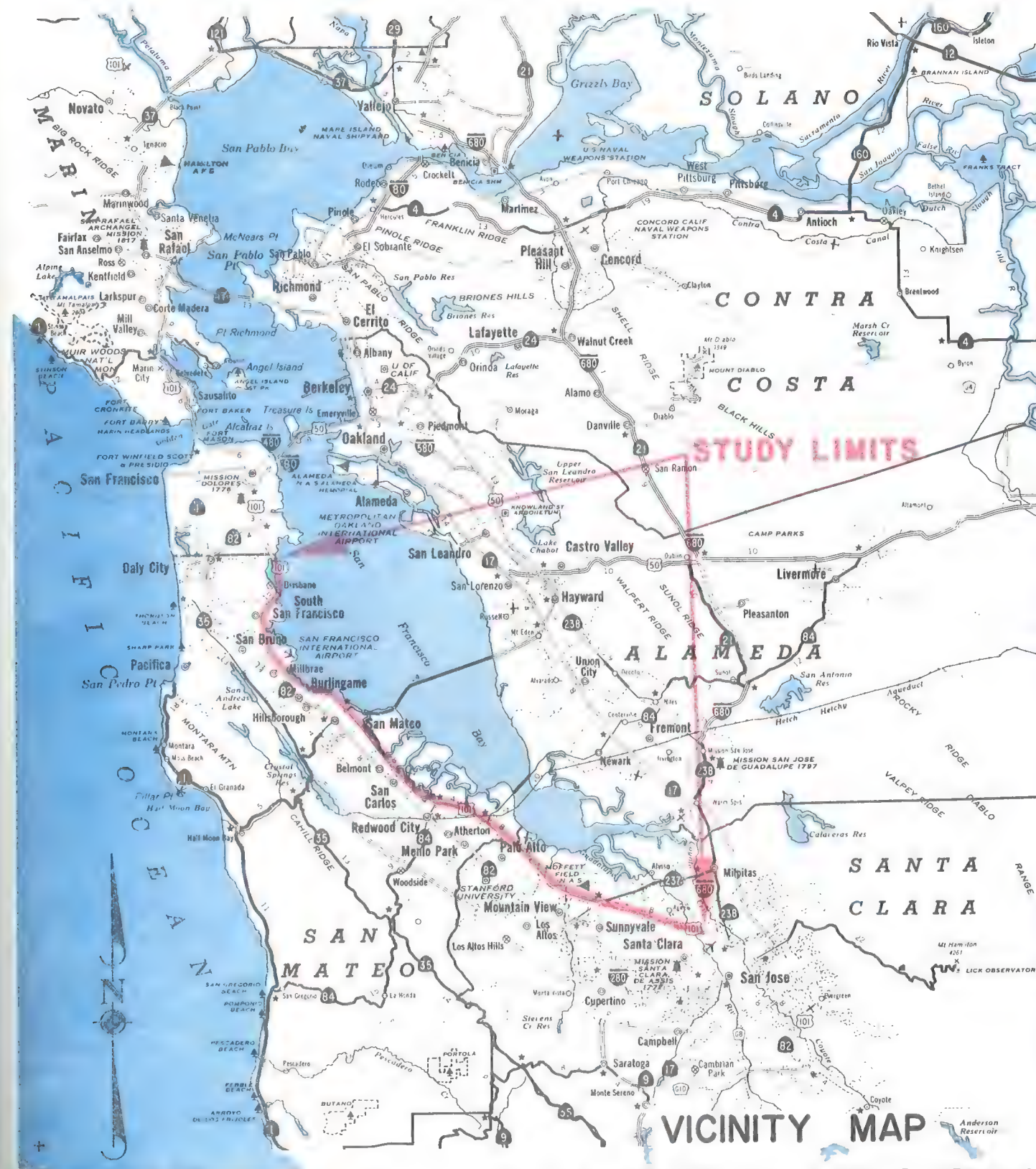


## TYPICAL VIADUCT SECTION



## TYPICAL "T" STRUCTURE SECTION





# FEASIBILITY OF DOUBLE DECKING ROUTE 101

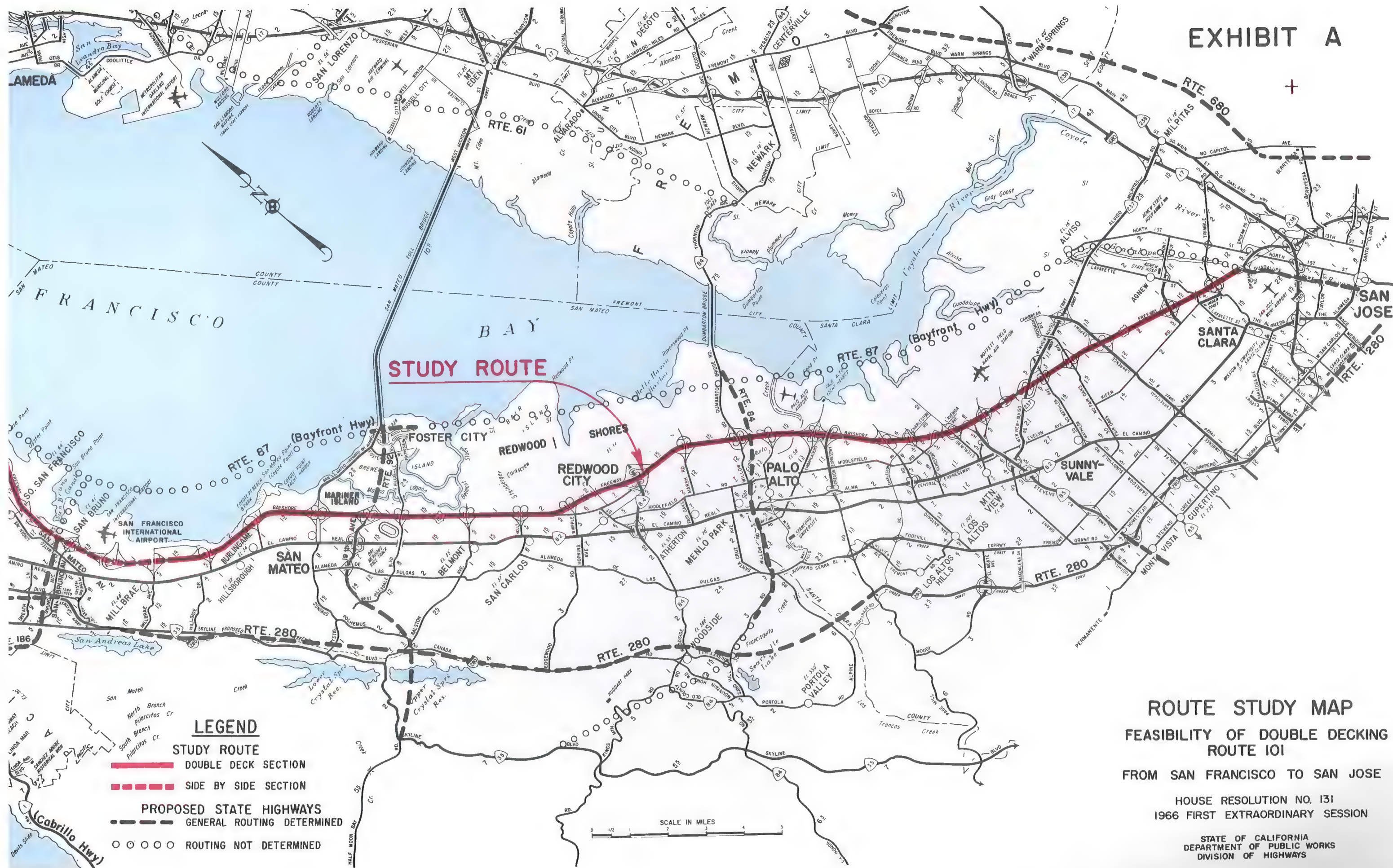
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STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS



EXHIBIT A

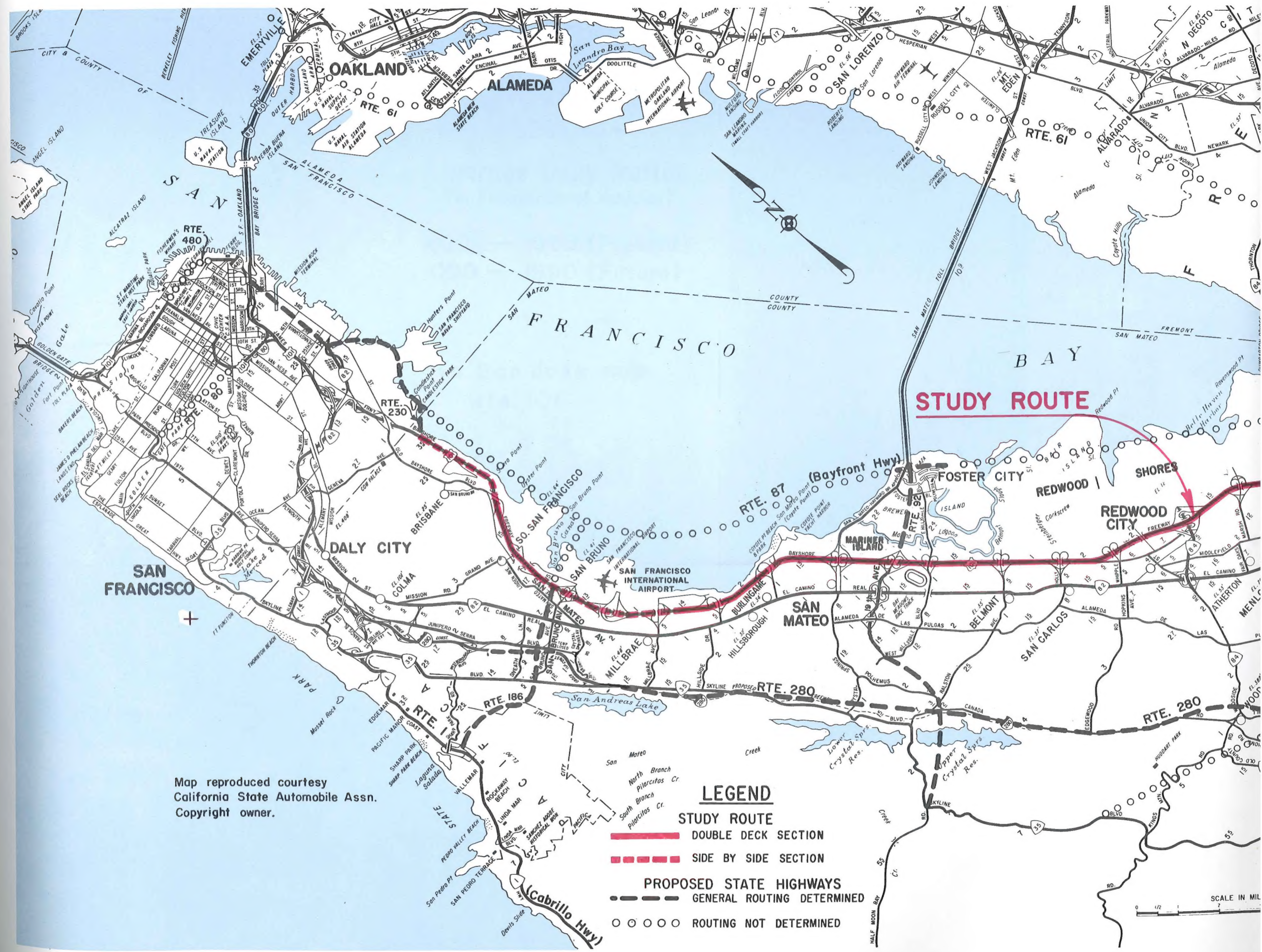


ROUTE STUDY MAP  
FEASIBILITY OF DOUBLE DECKING  
ROUTE 101  
FROM SAN FRANCISCO TO SAN JOSE

HOUSE RESOLUTION NO. 131  
1966 FIRST EXTRAORDINARY SESSION

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS





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**LEGEND**

- STUDY ROUTE**
  - DOUBLE DECK SECTION
  - SIDE BY SIDE SECTION
- PROPOSED STATE HIGHWAYS**
  - GENERAL ROUTING DETERMINED
  - ROUTING NOT DETERMINED

SCALE IN MILES  
0 1/2 1 2

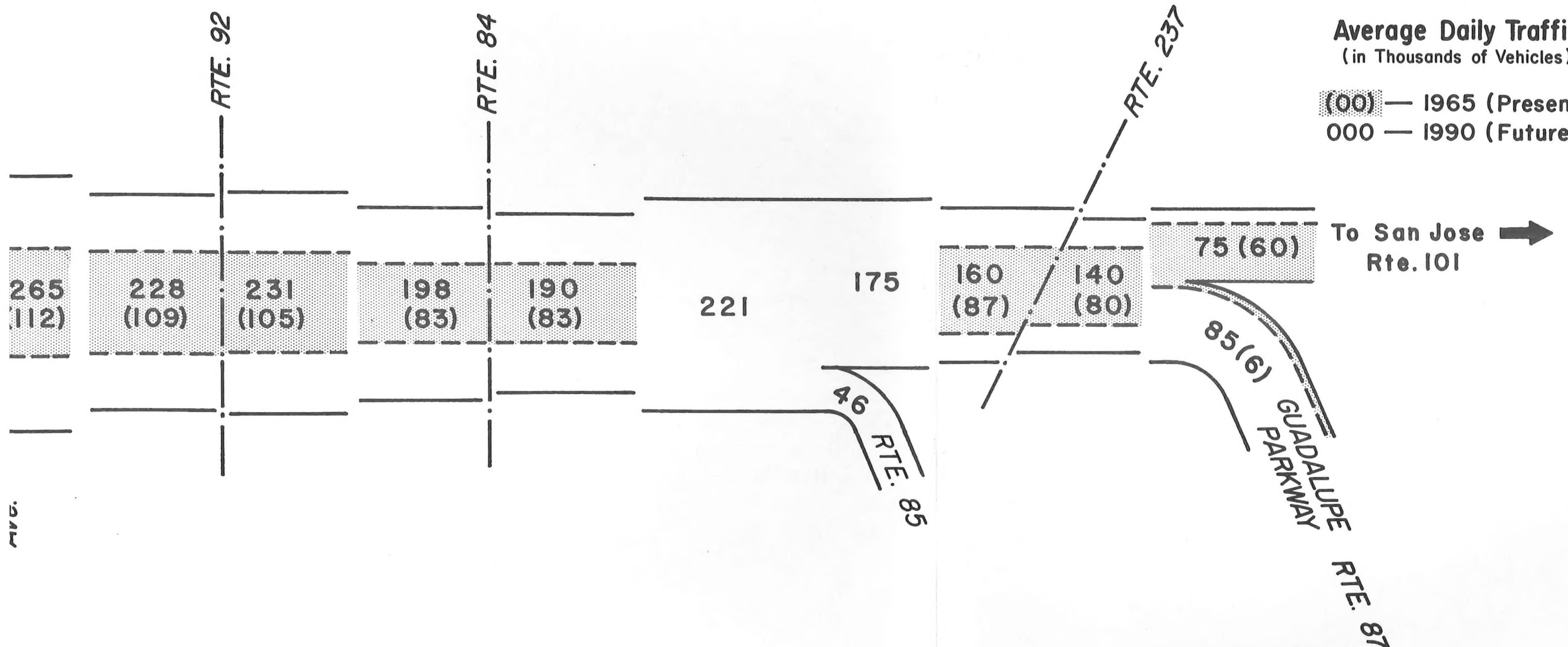


# EXHIBIT B

- LEGEND -

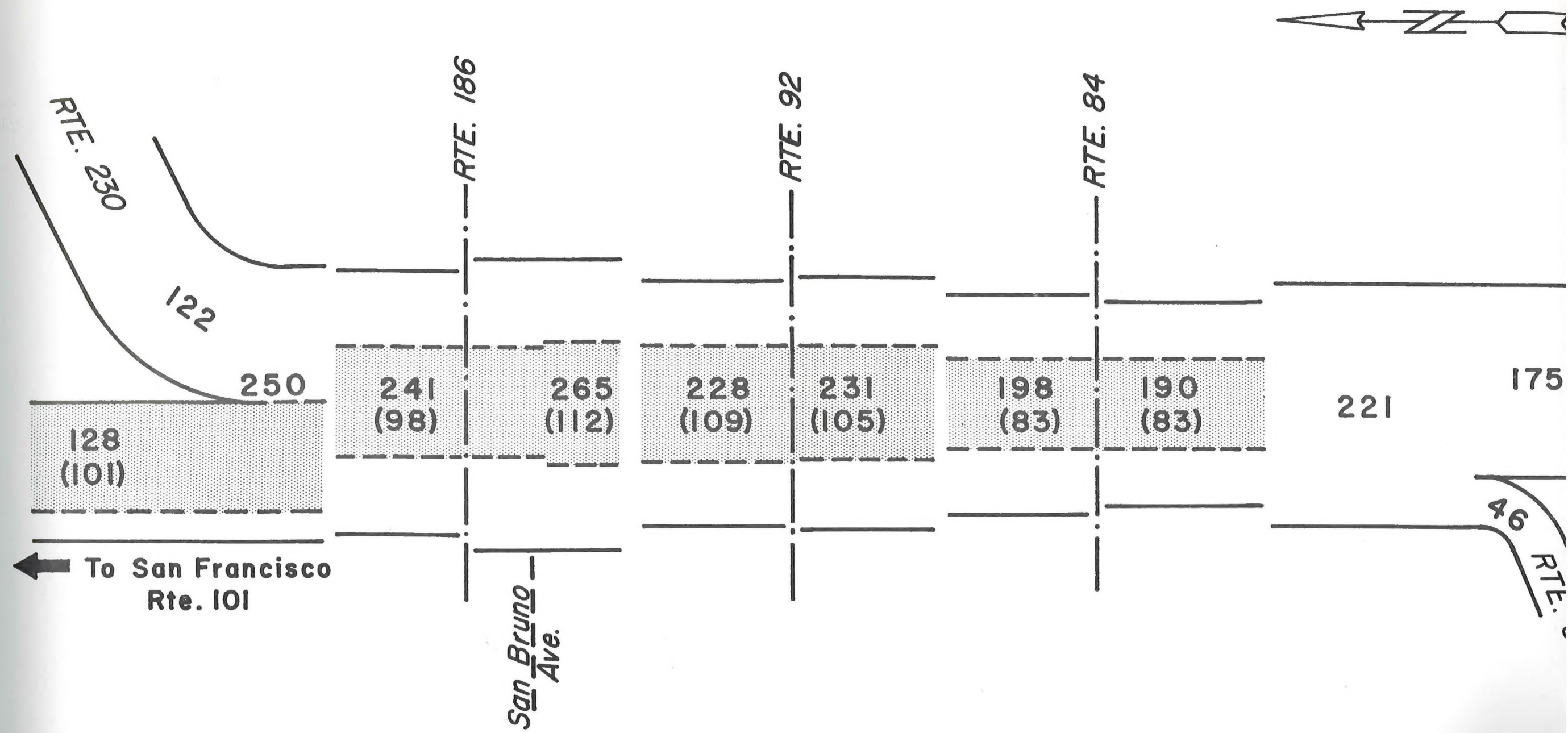
**Average Daily Traffic**  
(in Thousands of Vehicles)

(00) — 1965 (Present)  
000 — 1990 (Future)



## PTIONS

South of Route 230.  
ompleted.



### 1990 TRAFFIC ASSUMPTIONS

1. No Route 87 (Bayfront) Freeway, South of Route 230.
2. All other Freeways in corridor completed.



# EXHIBIT C TYPICAL SECTIONS

